

What is claimed is:

1. A method of creating a resin mass comprising the steps of:
 combining a resin, a hardening agent, a hydrocarbon diluent, a silane coupling agent, a foaming agent, a compressible gas, and a degradable material to form a resin composition;
 placing the resin composition in a subterranean formation; and,
 allowing the resin to substantially cure and the degradable material to substantially degrade so as to form a permeable, hardened resin mass.
2. The method of claim 1 wherein the resin comprises a phenolic resin, a furan/furfuryl alcohol resin, a phenolic/latex resin, a phenol formaldehyde resin, a polyester resin; a hybrid polyester resin; a copolymers polyester resin; a polyurethane resin; a hybrid polyurethane resin; a copolymers polyurethane resin, an acrylate resins, or a combination thereof.
3. The method of claim 1 wherein the resin comprises an epoxy resin.
4. The method of claim 1 wherein the resin comprises a furan resin.
5. The method of claim 1 wherein the hardening agent comprises an amine, an aromatic amine, a polyamine, an aliphatic amine, a cyclo-aliphatic amine, an amide, a polyamide, 2-ethyl-4-methyl imidazole, 1,1,3-trichlorotrifluoroacetone, or a combination thereof.
6. The method of claim 1 wherein the hardening agent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.
7. The method of claim 1 wherein the hydrocarbon diluent comprises one or more aromatic hydrocarbons.
8. The method of claim 7 wherein the hydrocarbon diluent comprises toluene, ethylbenzene, n-propylbenzene; isopropylbenzene, n-butylbenzene, isobutylbenzene, cyclohexylbenzene, n-hexylbenzene, xylene, diethylbenzene, 2-chloro-p-xylene diisopropylbenzene, 2-nitro-p-xylene, cymene, durene, isodurene, trimethylbenzene, triethylbenzene, dibutylbenzene, penta-methylbenzene, 1-pentyl-3-ethylbenzene, p-pentyltoluene, 1-hexyl-3-isobutylbenzene, m-hexyltoluene, 1-heptyl-3-isopropylbenzene, p-heptyltoluene, 1-heptyl-3-ethylbenzene, 1-octyl-3-butylbenzene, 1-octyl-3-propylbenzene, p-octyltoluene, 1-nonyl-3-ethylbenzene, p-nonyltoluene, 1-dodecyl-3-ethylbenzene, p-isodecyltoluene, 1-decyl-3-isotridecylbenzene, or combinations thereof.

9. The method of claim 1 wherein the hydrocarbon diluent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.
10. The method of claim 1 wherein the silane coupling agent comprises N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, or a combination thereof.
11. The method of claim 1 wherein the silane coupling agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.
12. The method of claim 1 wherein the foaming agent comprises a fluorocarbon surfactant.
13. The method of claim 12 wherein the foaming agent comprises a fluorinated alkyl alkoxylate, a fluorinated alkyl ester, a fluorinated aliphatic polymeric ester, or a combination thereof.
14. The method of claim 1 wherein the foaming agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.
15. The method of claim 1 wherein the compressible gas comprises air, nitrogen, or a combination thereof.
16. The method of claim 1 wherein the compressible gas comprises from about 6 to about 12 pounds per gallon of the resin composition by weight of the sum of all the other components in the resin composition.
17. The method of claim 1 wherein the degradable material comprises a degradable polymer, a dehydrated salt, a material that degrades when subjected to the subterranean formation temperature, or a combination thereof.
18. The method of claim 17 wherein the degradable polymer comprises a polysaccharide; a chitin; a chitosan; a protein; an aliphatic polyester; a poly(lactide); a poly(glycolide); a poly(ϵ -caprolactone); a poly(hydroxybutyrate); a poly(anhydride); an aliphatic polycarbonate; a poly(orthoester); a poly(amino acid); a poly(ethylene oxide); a polyphosphazene; a polyvinyl alcohol; a poly ethylene oxide; a poly(adipic anhydride), a poly(suberic anhydride), a poly(sebacic anhydride), a poly(dodecanedioic anhydride), a poly(maleic anhydride), a poly(benzoic anhydride); or a combination thereof.
19. The method of claim 17 wherein the dehydrated salt comprises a particulate solid anhydrous borate material.

20. The method of claim 1 wherein the degradable material comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

21. The method of claim 1 wherein the resin composition further comprises a filler material.

22. The method of claim 21 wherein the filler material comprises sand, nut hulls, bauxite, ceramics, polymeric materials, fly ash, bottom ash, or a combination thereof.

23. The method of claim 21 wherein the filler comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

24. A method of controlling the migration of particulates in a subterranean formation comprising the steps of:

isolating a zone in a subterranean formation;

providing a resin composition comprising a resin, a hardening agent, a hydrocarbon diluent, a silane coupling agent, a foaming agent, a compressible gas, and a degradable material;

placing the resin composition in at least a portion of the zone; and,

allowing the resin to substantially cure and the degradable material to substantially degrade so as to form a permeable, hardened resin mass.

25. The method of claim 24 wherein the resin comprises an epoxy resin, a furan resin, a phenolic resin, a furan/furfuryl alcohol resin, a phenolic/latex resin, a phenol formaldehyde resin, a polyester resin; a hybrid polyester resin; a copolymers polyester resin; a polyurethane resin; a hybrid polyurethane resin; a copolymers polyurethane resin, an acrylate resins, or a combination thereof.

26. The method of claim 24 wherein the hardening agent comprises an amine, an aromatic amine, a polyamine, an aliphatic amine, a cyclo-aliphatic amine, an amide, a polyamide, 2-ethyl-4-methyl imidazole, 1,1,3-trichlorotrifluoroacetone, or a combination thereof.

27. The method of claim 24 wherein the hardening agent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

28. The method of claim 24 wherein the hydrocarbon diluent comprises one or more aromatic hydrocarbons.

29. The method of claim 24 wherein the hydrocarbon diluent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

30. The method of claim 24 wherein the silane coupling agent comprises N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, or a combination thereof.

31. The method of claim 24 wherein the silane coupling agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

32. The method of claim 24 wherein the foaming agent comprises a fluorinated alkyl alkoxylate, a fluorinated alkyl ester, a fluorinated aliphatic polymeric ester, or a combination thereof.

33. The method of claim 24 wherein the foaming agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

34. The method of claim 24 wherein the compressible gas comprises air, nitrogen, or a combination thereof.

35. The method of claim 24 wherein the compressible gas comprises from about 6 to about 12 pounds per gallon of the resin composition by weight of the sum of all the other components in the resin composition.

36. The method of claim 24 wherein the degradable material comprises a degradable polymer, a dehydrated salt, a material that degrades when subjected to the subterranean formation temperature, or a combination thereof.

37. The method of claim 24 wherein the degradable material comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

38. The method of claim 24 further comprising a filler material.

39. The method of claim 38 wherein the filler material comprises sand, nut hulls, bauxite, ceramics, polymeric materials, fly ash, bottom ash, or a combination thereof.

40. The method of claim 38 wherein the filler comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

41. A method of at least partially maintaining the integrity of a subterranean fracture comprising the steps of:

providing a resin composition comprising resin, a hardening agent, a hydrocarbon diluent, a silane coupling agent, a foaming agent, a compressible gas, and a degradable material;

placing the resin composition into at least one fracture in a subterranean formation; and,

allowing the resin to substantially cure and the degradable material to substantially degrade so as to form a permeable, hardened resin mass.

42. The method of claim 41 wherein the resin comprises an epoxy resin, a furan resin, a phenolic resin, a furan/furfuryl alcohol resin, a phenolic/latex resin, a phenol formaldehyde resin, a polyester resin; a hybrid polyester resin; a copolymers polyester resin; a polyurethane resin; a hybrid polyurethane resin; a copolymers polyurethane resin, an acrylate resins, or a combination thereof.

43. The method of claim 41 wherein the hardening agent comprises an amine, an aromatic amine, a polyamine, an aliphatic amine, a cyclo-aliphatic amine, an amide, a polyamide, 2-ethyl-4-methyl imidazole, 1,1,3-trichlorotrifluoroacetone, or a combination thereof.

44. The method of claim 41 wherein the hardening agent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

45. The method of claim 41 wherein the hydrocarbon diluent comprises one or more aromatic hydrocarbons.

46. The method of claim 41 wherein the hydrocarbon diluent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

47. The method of claim 41 wherein the silane coupling agent comprises N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, or a combination thereof.

48. The method of claim 41 wherein the silane coupling agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

49. The method of claim 41 wherein the foaming agent comprises a fluorinated alkyl alkoxylate, a fluorinated alkyl ester, a fluorinated aliphatic polymeric ester, or a combination thereof.

50. The method of claim 41 wherein the foaming agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

51. The method of claim 41 wherein the compressible gas comprises air, nitrogen, or a combination thereof.

52. The method of claim 41 wherein the compressible gas comprises from about 6 to about 12 pounds per gallon of the resin composition by weight of the sum of all the other components in the resin composition.

53. The method of claim 41 wherein the degradable material comprises a degradable polymer, a dehydrated salt, a material that degrades when subjected to the subterranean formation temperature, or a combination thereof.

54. The method of claim 41 wherein the degradable material comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

55. The method of claim 41 further comprising a filler material.

56. The method of claim 55 wherein the filler material comprises sand, nut hulls, bauxite, ceramics, polymeric materials, fly ash, bottom ash, or a combination thereof.

57. The method of claim 55 wherein the filler comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

58. A resin composition useful in subterranean applications comprising a resin, a hardening agent, a hydrocarbon diluent, a silane coupling agent, a foaming agent, a compressible gas, and a degradable material.

59. The resin composition of claim 58 wherein the resin comprises a phenolic resin, a furan/furfuryl alcohol resin, a phenolic/latex resin, a phenol formaldehyde resin, a polyester resin; a hybrid polyester resin; a copolymers polyester resin; a polyurethane resin; a hybrid polyurethane resin; a copolymers polyurethane resin, an acrylate resins, or a combination thereof.

60. The resin composition of claim 58 wherein the resin comprises an epoxy resin.

61. The resin composition of claim 58 wherein the resin comprises a furan resin.

62. The resin composition of claim 58 wherein the hardening agent comprises an amine, an aromatic amine, a polyamine, an aliphatic amine, a cyclo-aliphatic amine, an amide, a polyamide, 2-ethyl-4-methyl imidazole, 1,1,3-trichlorotrifluoroacetone, or a combination thereof.

63. The resin composition of claim 58 wherein the hardening agent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

64. The resin composition of claim 58 wherein the hydrocarbon diluent comprises one or more aromatic hydrocarbons.

65. The resin composition of claim 64 wherein the hydrocarbon diluent comprises toluene, ethylbenzene, n-propylbenzene; isopropylbenzene, n-butylbenzene, isobutylbenzene, cyclohexylbenzene, n-hexylbenzene, xylene, diethylbenzene, 2-chloro-p-xylene diisopropylbenzene, 2-nitro-p-xylene, cymene, durene, isodurene, trimethylbenzene, triethylbenzene, dibutylbenzene, penta-methylbenzene, 1-pentyl-3-ethylbenzene, p-pentyltoluene, 1-hexyl-3-isobutylbenzene, m-hexyltoluene, 1-heptyl-3-isopropylbenzene, p-heptyltoluene, 1-heptyl-3-ethylbenzene, 1-octyl-3-butylbenzene, 1-octyl-3-propylbenzene, p-octyltoluene, 1-nonyl-3-ethylbenzene, p-nonyltoluene, 1-dodecyl-3-ethylbenzene, p-isodecyltoluene, 1-decyl-3-isotridecylbenzene, or combinations thereof.

66. The resin composition of claim 58 wherein the hydrocarbon diluent comprises from about 40% to about 60% of the resin composition by weight of the resin therein.

67. The resin composition of claim 58 wherein the silane coupling agent comprises N-2-(aminoethyl)-3-aminopropyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, n-beta-(aminoethyl)-gamma-aminopropyl trimethoxysilane, or a combination thereof.

68. The resin composition of claim 58 wherein the silane coupling agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

69. The resin composition of claim 58 wherein the foaming agent comprises a fluorocarbon surfactant.

70. The resin composition of claim 69 wherein the foaming agent comprises a fluorinated alkyl alkoxylate, a fluorinated alkyl ester, a fluorinated aliphatic polymeric ester, or a combination thereof.

71. The resin composition of claim 58 wherein the foaming agent comprises from about 0.01% to about 5% of the resin composition by weight of the resin therein.

72. The resin composition of claim 58 wherein the compressible gas comprises air, nitrogen, or a combination thereof.

73. The resin composition of claim 58 wherein the compressible gas comprises from about 6 to about 12 pounds per gallon of the resin composition by weight of the sum of all the other components in the resin composition.

74. The resin composition of claim 58 wherein the degradable material comprises a degradable polymer, a dehydrated salt, a material that degrades when subjected to the subterranean formation temperature, or a combination thereof.

75. The resin composition of claim 74 wherein the degradable polymer comprises a polysaccharide; a chitin; a chitosan; a protein; an aliphatic polyester; a poly(lactide); a poly(glycolide); a poly(ϵ -caprolactone); a poly(hydroxybutyrate); a poly(anhydride); an aliphatic polycarbonate; a poly(orthoester); a poly(amino acid); a poly(ethylene oxide); a polyphosphazene; a polyvinyl alcohol; a poly ethylene oxide; a poly(adipic anhydride), a poly(suberic anhydride), a poly(sebacic anhydride), a poly(dodecanedioic anhydride), a poly(maleic anhydride), a poly(benzoic anhydride); or a combination thereof.

76. The resin composition of claim 74 wherein the dehydrated salt comprises a particulate solid anhydrous borate material.

77. The resin composition of claim 58 wherein the degradable material comprises from about 1% to about 60% of the resin composition by weight of the resin therein.

78. The resin composition of claim 58 further comprising a filler material.

79. The resin composition of claim 78 wherein the filler material comprises sand, nut hulls, bauxite, ceramics, polymeric materials, fly ash, bottom ash, or a combination thereof.

80. The resin composition of claim 78 wherein the filler comprises from about 1% to about 60% of the resin composition by weight of the resin therein.